

CLAIMS

The subject matter claimed is:

1. A method for increasing remediation of a contaminated subsurface formation, the method comprising:

5 (a) fracturing the subsurface formation to result in a network of fractures in the formation; and

(b) simultaneously injecting an aqueous slurry comprising an optional proppant and a solid-phase or nonaqueous-phase treatment agent into the network of fractures.

2. The method of claim 1 wherein the fracturing comprises hydraulic fracturing.

10 3. The method of claim 1 wherein the injecting comprises applying ultrasound, pulse injection, pneumatic fracturing, jet injection, or combinations thereof.

4. The method of claim 1 wherein the subsurface formation is a low permeability formation.

5. The method of claim 1 wherein the proppant comprises sand.

15 6. The method of claim 1 wherein the solid-phase or nonaqueous-phase treatment agent comprises chitin.

7. The method of claim 1 wherein the solid-phase or nonaqueous-phase treatment agent comprises a high-viscosity agent.

8. The method of claim 1 wherein the solid-phase or nonaqueous-phase treatment agent comprises an agent for increasing abiotic reduction of contaminants.

5 9. The method of claim 8 wherein the agent for increasing abiotic reduction of contaminants comprises zero-valent iron.

10. The method of claim 1 wherein the subsurface formation is contaminated with a chlorinated contaminant.

11. The method of claim 10 wherein the solid-phase or nonaqueous-phase treatment agent comprises an electron donor for increasing anaerobic reductive dechlorination of the chlorinated contaminant.

12. The method of claim 11 wherein the electron donor comprises chitin.

13. The method of claim 10 wherein the chlorinated contaminant comprises perchloroethylene (PCE), trichloroethylene (TCE), dichloroethylene (DCE), vinyl chloride (VC), and mixtures thereof.

14. A method for treating groundwater comprising a plume of contamination in a subsurface formation, the method comprising:

- (a) determining the size, depth, and direction of movement of the plume of contamination in the subsurface formation;
- 5 (b) creating a treatment zone configured for intercepting the plume of contamination, comprising
 - (1) fracturing the subsurface formation to result in a network of fractures in the formation, and
 - (2) simultaneously injecting an aqueous slurry comprising an optional proppant and a solid-phase or nonaqueous-phase treatment agent into the network of fractures; and
- (c) monitoring conversion of one or more contaminants in the plume of contamination into one or more non-hazardous products.

15. The method of claim 14 wherein the fracturing comprises hydraulic fracturing.

16. The method of claim 14 wherein the injecting comprises applying ultrasound, pulse injection, pneumatic fracturing, jet injection, or combinations thereof.

17. The method of claim 14 wherein the proppant comprises sand.

18. The method of claim 14 wherein the solid-phase or nonaqueous-phase treatment

agent comprises chitin.

19. The method of claim 14 wherein the solid-phase or nonaqueous-phase treatment agent comprises a high-viscosity agent.

20. The method of claim 14 wherein the solid-phase or nonaqueous-phase treatment agent comprises an agent for increasing abiotic reduction of contaminants.

21. The method of claim 20 wherein the agent for increasing abiotic reduction of contaminants comprises zero-valent iron.

22. The method of claim 14 wherein the subsurface formation is contaminated with a chlorinated contaminant.

10 23. The method of claim 22 wherein the solid-phase or nonaqueous-phase treatment agent comprises an electron donor for increasing anaerobic reductive dechlorination of the chlorinated contaminant.

24. The method of claim 23 wherein the electron donor comprises chitin.

15 25. The method of claim 22 wherein the chlorinated contaminant comprises perchloroethylene (PCE), trichloroethylene (TCE), dichloroethylene (DCE), vinyl chloride (VC),

and mixtures thereof.

26. A method for increasing anaerobic reductive dechlorination of a chlorinated source area in a low permeability formation comprising:

5 (a) fracturing the low permeability formation to result in a network of fractures in the formation; and

(b) partially filling the network of fractures with an aqueous slurry comprising a proppant and a solid phase electron donor.

27. The method of claim 26 wherein the solid phase electron donor comprises chitin.

28. The method of claim 26 wherein the proppant comprises sand.

10 29. The method of claim 26 wherein the partially filling the network of fractures comprises hydraulic fracturing.

30. The method of claim 26 wherein the partially filling the network of fractures comprises applying ultrasound.

15 31. The method of claim 26 wherein the partially filling the network of fractures comprises pulse injection.

32. The method of claim 26 wherein the partially filling the network of fractures comprises pneumatic fracturing.

33. The method of claim 26 wherein the partially filling the network of fractures comprises jet injection.